SYP-060RE (7783/47)

Mass Spectrometer System and Method for Matrix-Assisted Laser Desorption Measurements

CLAIMS AS ALLOWED FEBRUARY 26, 2001

112. (Amended) A system for obtaining mass data comprising:

a mass spectrometer comprising an ion source chamber, wherein the ion source chamber comprises

a sample receiving stage adapted to support a sample support, and

a mechanism to move the sample receiving stage in an x direction and in a y direction perpendicular to the x direction, wherein the x direction and the y direction lie substantially in the same plane;

a laser source in communication with the ion source chamber, wherein the laser source is adapted to provide a laser pulse to a sample support in the ion source chamber;

a vacuum lock chamber connected with the ion source chamber, wherein the vacuum lock chamber comprises a sample support holder adapted to support more than one sample support; and

a sample support transfer mechanism adapted to introduce a sample support from the vacuum lock chamber into the ion source chamber and to associate a sample support with the sample receiving stage;

wherein the sample support transfer mechanism comprises a first transfer mechanism adapted to disassociate a sample support from the sample support holder; and a second transfer mechanism adapted to introduce a sample support into association with the sample receiving stage.

113. The system of claim 112 further comprising an electronic control mechanism to control at least the mechanism to move the sample receiving stage.

114. The system of claim 113 wherein the electronic control mechanism comprises a computer.

115. The system of claim 112 wherein the laser source is adapted to provide a laser pulse to irradiate a sample on a sample support.

116. (Amended) The system of claim 112 wherein the sample support transfer mechanism is further adapted to move a sample support from the ion source chamber to the vacuum lock chamber and into association with the sample support holder.

117. The system of claim 112 wherein the sample support holder comprises a cassette.

118. The system of claim 117 wherein the cassette is adapted to contain up to 20 sample supports.

119. The system of claim 112 further comprising more than one sample support adapted to support a plurality of samples each disposed at fixed locations on the sample support.

120. The system of claim 119 wherein at least one sample support further comprises a location identifier associated with at least one of the fixed locations.

121. The system of claim 120 wherein the location identifier comprises a reference marking positioned on the sample support.

122. The system of claim 119 wherein at least one sample support comprises a support identifier.

123. The system of claim 122 wherein the support identifier comprises a bar code disposed on the sample support.

124. The system of claim 119 wherein at least one sample support remains in the vacuum lock chamber while another sample support is in the ion source chamber.

125. The system of claim 124 wherein the at least one sample support in the vacuum lock chamber is supported in the sample support holder.

126. The system of claim 119 wherein each of the sample supports comprises a magnetic material.

127. The system of claim 112 further comprising a door member positioned between the ion source chamber and the vacuum lock chamber.

128. The system of claim 127 further comprising a vacuum pump independently associated with the vacuum lock chamber.

129. The system of claim 112 further comprising a sample preparation system associated with the vacuum lock chamber, wherein the sample preparation system is adapted to deliver a plurality of samples to a sample plate prior to introduction to the vacuum lock chamber.

130. The system of claim 129 wherein the sample preparation system comprises a sample loading mechanism adapted to position each of a plurality of liquid samples on a sample support.

131. The system of claim 130 wherein the sample preparation system further comprises a sample curing chamber to dry each of the plurality of liquid samples on a sample support.

132. (Amended) A system for obtaining mass data comprising:

a mass spectrometer comprising an ion source chamber, wherein the ion source chamber comprises

a sample receiving stage adapted to support a sample support, and

a mechanism to move the sample receiving stage in an x direction and in a y direction perpendicular to the x direction, wherein the x direction and the y direction lie substantially in the same plane;

a laser source in communication with the ion source chamber, wherein the laser source is adapted to provide a laser pulse to a sample on a sample support in the ion source chamber;

a vacuum lock chamber connected with the ion source chamber, wherein the vacuum lock chamber comprises a sample support holder adapted to support more than one sample support;

a sample support transfer mechanism adapted to introduce a sample support from the vacuum lock chamber into the ion source chamber and to associate a sample support with the sample receiving stage, and to dissociate a sample support from the sample receiving stage and to move a sample support from the ion source chamber to the vacuum lock chamber;

wherein the sample support transfer mechanism comprises a first transfer mechanism adapted to disassociate a sample support from the sample support holder; and a second transfer mechanism adapted to introduce a sample support into association with the sample receiving stage; and

an electronic control mechanism to control at least the mass spectrometer, the mechanism to move the sample receiving stage, and the sample support transfer mechanism.

134. The system of claim 132 wherein the electronic control mechanism is adapted to control independently the mass spectrometer, the mechanism to move the sample receiving stage, and the sample support transfer mechanism.

135. The system of claim 132 wherein the sample support holder comprises a cassette.

136. The system of claim 135 wherein the cassette is adapted to contain up to 20 sample supports.

137. The system of claim 132 further comprising more than one sample support adapted to support a plurality of samples each disposed at fixed locations on the sample support.

138. The system of claim 137 wherein at least one sample support further comprises a location identifier associated with at least one of the fixed locations.

139. The system of claim 138 wherein the location identifier comprises a reference marking positioned on the sample support.

140. The system of claim 137 wherein at least one sample support comprises a support identifier.

141. The system of claim 140 wherein the support identifier comprises a bar code disposed on the sample support.

142. The system of claim 137 wherein at least one sample support remains in the vacuum lock chamber while another sample support is in the ion source chamber.

143. The system of claim 142 wherein the at least one sample support in the vacuum lock chamber is supported in the sample support holder.

144. The system of claim 137 wherein each of the sample supports comprises a magnetic material.

145. The system of claim 132 further comprising a door member positioned between the ion source chamber and the vacuum lock chamber.

146. The system of claim 145 further comprising a vacuum pump independently associated with the vacuum lock chamber.

147. The system of claim 132 further comprising a sample preparation system associated with the vacuum lock chamber, wherein the sample preparation system is adapted to deliver a plurality of samples to a sample plate prior to introduction to the vacuum lock chamber.

148. The system of claim 147 wherein the sample preparation system comprises a sample loading mechanism adapted to position each of a plurality of liquid samples on a sample support.

149. The system of claim 148 wherein the sample preparation system further comprises a sample curing chamber to dry each of the plurality of liquid samples on a sample support.

150. (Amended) A system for obtaining mass data comprising:

a mass spectrometer comprising an ion source chamber, wherein the ion source chamber comprises

a sample receiving stage adapted to support a sample support, and

a mechanism to move the sample receiving stage;

a laser source in communication with the ion source chamber, wherein the laser source is adapted to provide a laser pulse to a sample support in the ion source chamber;

a vacuum lock chamber connected with the ion source chamber;

a sample storage chamber connected to the vacuum lock chamber, wherein the sample storage chamber comprises a sample support holder adapted to support at least one sample support; and

a sample support transfer mechanism adapted to move a sample support from the sample storage chamber to the vacuum lock chamber and into the ion source chamber, and to associate a sample support with the sample receiving stage;

wherein the sample support transfer mechanism comprises a first transfer mechanism adapted to move a sample support from the sample storage chamber to the vacuum lock chamber; and a second transfer mechanism adapted to introduce a sample support from the vacuum lock chamber into the ion source chamber.

152. The system of claim 150 wherein the mechanism to move the sample receiving stage is adapted to move the sample receiving stage in an x direction and in a y direction

perpendicular to the x direction, wherein the x direction and the y direction lie substantially in the same plane.

153. The system of claim 150 wherein the sample support transfer mechanism is further adapted to move a sample support from the ion source chamber to the vacuum lock chamber and from the vacuum lock chamber to the sample storage chamber.

154. The system of claim 150 further comprising an electronic control mechanism to control at least the mechanism to move the sample receiving stage.

155. The system of claim 154 wherein the electronic control mechanism comprises a computer.

156. The system of claim 150 wherein the laser source is adapted to provide a laser pulse to irradiate a sample on a sample support.

157. The system of claim 150 wherein the sample support holder comprises a cassette.

158. The system of claim 157 wherein the cassette is adapted to contain up to 20 sample supports.

159. The system of claim 150 further comprising more than one sample support adapted to support a plurality of samples each disposed at fixed locations on the sample support.

160. The system of claim 159 wherein at least one sample support further comprises a location identifier associated with at least one of the fixed locations.

161. The system of claim 160 wherein the location identifier comprises a reference marking positioned on the sample support.

162. The system of claim 159 wherein at least one sample support comprises a support identifier.

163. The system of claim 162 wherein the support identifier comprises a bar code disposed on the sample support.

164. The system of claim 159 wherein at least one sample support remains in the sample storage chamber while another sample support is in the ion source chamber.

165. The system of claim 159 wherein the at least one sample support in the vacuum lock chamber is supported in the sample support holder.

166. The system of claim 159 wherein each of the sample supports comprises a magnetic material.

167. The system of claim 160 further comprising a first door member positioned between the ion source chamber and the vacuum lock chamber.

168. The system of claim 167 further comprising a second door member positioned between the vacuum chamber and the sample storage chamber.

169. The system of claim 168 further comprising a first vacuum pump independently associated with the vacuum lock chamber.

170. The system of claim 169 further comprising a second vacuum pump independently associated with the sample storage chamber.

171. The system of claim 150 further comprising a sample preparation system associated with the sample storage chamber, wherein the sample preparation system is adapted to deliver a plurality of samples to a sample plate prior to introduction to the sample storage chamber.

172. The system of claim 171 wherein the sample preparation system comprises a sample loading mechanism adapted to position each of a plurality of liquid samples on a sample support.

173. The system of claim 172 wherein the sample preparation system further comprises a sample curing chamber to dry each of the plurality of liquid samples on a sample support.

174. A system for obtaining mass data comprising:

a mass spectrometer comprising an ion source chamber, wherein the ion source chamber comprises

a sample receiving stage adapted to support a sample support, and

a mechanism to move the sample receiving stage;

a laser source in communication with the ion source chamber, wherein the laser source is adapted to provide a laser pulse to a sample support in the ion source chamber;

a vacuum lock chamber connected with the ion source chamber;

a sample storage chamber connected to the vacuum lock chamber, wherein the sample storage chamber comprises a sample support holder adapted to support at least one sample support;

a first sample support transfer mechanism adapted to move a sample support from the sample storage chamber to the vacuum lock chamber;

a second sample support transfer mechanism adapted to move a sample support from the vacuum lock chamber and into the ion source chamber, and to associate a sample support with the sample receiving stage; and

an electronic control mechanism to control at least the mechanism to move the sample receiving stage, the first sample support transfer mechanism, and the second sample support transfer mechanism.

175. The system of claim 174 wherein the mechanism to move the sample receiving stage is adapted to move the sample receiving stage in an x direction and in a y direction perpendicular to the x direction, wherein the x direction and the y direction lie substantially in the same plane.

176. The system of claim 174 wherein the second sample support transfer mechanism is further adapted to move a sample support from the ion source chamber to the vacuum lock chamber and the first sample support transfer mechanism is further adapted to move a sample support from the vacuum lock chamber to the sample storage chamber.

177. The system of claim 174 wherein the electronic control mechanism comprises a computer.

178. The system of claim 174 wherein the electronic control mechanism is adapted to control independently the mechanism to move the sample receiving stage, the first sample support transfer mechanism, and the second sample support transfer mechanism.

179. The system of claim 174 wherein the laser source is adapted to provide a laser pulse to irradiate a sample on a sample support.

180. The system of claim 174 wherein the sample support holder comprises a cassette.

181. The system of claim 180 wherein the cassette is adapted to contain up to 20 sample supports.

182. The system of claim 174 further comprising more than one sample support adapted to support a plurality of samples each disposed at fixed locations on the sample support.

183. The system of claim 182 wherein at least one sample support further comprises a location identifier associated with at least one of the fixed locations.

184. The system of claim 183 wherein the location identifier comprises a reference marking positioned on the sample support.

185. The system of claim 182 wherein at least one sample support comprises a support identifier.

186. The system of claim 185 wherein the support identifier comprises a bar code disposed on the sample support.

187. The system of claim 182 wherein at least one sample support remains in the sample storage chamber while another sample support is in the ion source chamber.

188. The system of claim 182 wherein the at least one sample support in the vacuum lock chamber is supported in the sample support holder.

189. The system of claim 182 wherein each of the sample supports comprises a magnetic material.

190. The system of claim 174 further comprising a first door member positioned between the ion source chamber and the vacuum lock chamber.

191. The system of claim 190 further comprising a second door member positioned between the vacuum chamber and the sample storage chamber.

192. The system of claim 191 further comprising a first vacuum pump independently associated with the vacuum lock chamber.

193. The system of claim 192 further comprising a second vacuum pump independently associated with the sample storage chamber.

194. The system of claim 174 further comprising a sample preparation system associated with the sample storage chamber, wherein the sample preparation system is adapted to deliver a plurality of samples to a sample plate prior to introduction to the sample storage chamber.

195. The system of claim 194 wherein the sample preparation system comprises a sample loading mechanism adapted to position each of a plurality of liquid samples on a sample support.

196. The system of claim 195 wherein the sample preparation system further comprises a sample curing chamber to dry each of the plurality of liquid samples on a sample support.

197. (Amended) A method of obtaining mass data comprising the steps of:

supporting each of a plurality of samples at a fixed location on one of a plurality of sample supports;

providing a vacuum lock chamber to receive the plurality of sample supports and to maintain one or more of the sample supports within a vacuum controlled environment while the plurality of samples on another of the sample supports are struck by laser pulses;

inputting and outputting individually a desired number of the plurality of sample supports between a sample support holder and the vacuum lock chamber with a first transfer mechanism;

inputting and outputting individually a desired number of the plurality of sample supports between the vacuum lock chamber and an ion source chamber of a mass spectrometer with a second transfer mechanism;

moving each sample support within the ion source chamber in an x direction and a y direction perpendicular to the x direction; and

striking with a laser pulse a desired number of the plurality of samples on each sample support within the ion source chamber to desorb and ionize sample molecules.

198. The method of claim 197 further comprising the step of:

recording in a computer mass data corresponding to each of the plurality of samples struck with a laser pulse.

199. The method of claim 197 further comprising the step of:

introducing the plurality of sample supports into a sample storage chamber connected with the vacuum lock chamber, wherein a desired number of the plurality of sample supports are moved from the sample support chamber to the vacuum lock chamber.

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